

Serial No.: 10/037,429

Attorney Docket No.: 53951-055

IN THE CLAIMS:

Claims 1-16. (Canceled).

Claim 17. (Currently Amended) A device for detecting leaks in a blood circuit, comprising:

a first leak detector that detects leaks by sensing any presence of blood outside said blood circuit, said first leak detector being located to detect leaks from a first portion of said blood circuit located remote from a patient;

said outside being a non-wetted environment of said blood circuit;

a second leak detector that detects leaks by sensing air infiltration into lines under negative pressure;

said second leak detector being configured to detect leaks in lines connecting said patient to said first portion;

a mechanism that insures that at least part of said lines are under negative pressure at least part of the time during a treatment such that a detectable air infiltration indicates a presence of a leak in said lines;

an alarm device that outputs an alarm signal responsively to a detection of a leak by said first or second leak detector.

Claim 18 (previously presented) A device as in claim 17, wherein said second leak detector includes a liquid fluid sensor below said circuit first portion.

Claim 19 (Canceled).

Claim 20 (previously presented) A device as in claim 17, where in said first leak detector is located below said first portion, said device further comprising a flow director to concentrate any leaking fluid toward said first leak detector.

Claims 21 – 59 (Canceled).

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Claim 60 (Currently Amended) A device for detecting a leak from a blood circuit of an extracorporeal blood treatment machine, comprising the steps of:

respective detectors located to detect leaks of blood from respective portions of a blood circuit;

at least two of said respective detectors including sensors configured to detect different physical effects correlated with one or more blood leaks;

said respective portions including parts that are non-overlapping;

wherein said different physical effects include the infiltration of air into a blood circuit and the presence of blood outside said blood circuit;

said outside being a non-wetted environment of said blood circuit;

an output device connected to receive signals from said respective detectors and to output a signal responsively thereto and an alarm connected to generate an output responsively to said signal;

wherein said output device and detectors are configured such that said signal indicates a leak if either of said respective different physical effects indicates a leak;

wherein at least one of said detectors includes an air sensor or bubble sensor and a mechanism adapted to periodically generate a negative pressure in said blood circuit such that air infiltrates said blood circuit through any openings therein.

61. (Original) A device as in claim 60, wherein said mechanism includes a mechanism adapted to reverse flow.

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Claims 62 – 69 (Canceled).

Claim 70 (Currently Amended) A device for detecting leaks in an extracorporeal blood circuit, comprising:

 a liquid detector positioned to detect blood or liquid outside a first portion of a blood circuit;

said outside being a non-wetted environment of said blood circuit;

 an air detector positioned to detect air inside a second portion of the blood circuit that is remote from the first portion;

 a positive displacement mechanism configured to periodically generate a negative pressure in said blood circuit such that air is caused to be infiltrated in portions that are otherwise not under negative pressure; and

 an alarm configured to signify the occurrence of a leak in response to either or both of said liquid detector and said air detector.

Claim 71 (previously presented) A device as in claim 70, wherein said positive displacement mechanism includes a reversible pump in said blood circuit.

Claim 72 (previously presented) A device as in claim 70, wherein said liquid detector is positioned within a housing that houses said blood circuit first portion.

Claim 73 (previously presented) A device as in claim 72, wherein said housing includes a funnel shaped portion to guide leaking blood to said liquid detector.

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Claim 74 (Currently Amended) A method for detecting leaks in a blood treatment machine, comprising the steps of:

 during a treatment operation, detecting liquid outside a blood circuit, at least a first portion of which is under non-negative pressure during a treatment operation;
 said outside being a non-wetted environment of said blood circuit;
 creating a temporary negative pressure at least two times during said treatment operation in at least a second portion of said blood circuit effective to cause air to infiltrate said second portion;
 detecting said air caused to infiltrate by said step of creating;
at least one of halting a pumping of blood in either or both of said first and second blood circuit portions or generating an alarm signal responsively to a result of either or both of said steps of detecting.

Claims 75 – 80 (Canceled)

Claim 81 (Previously Presented) A device for detecting leaks in a blood treatment circuit, comprising:

 a first leak detector that detects leaks by sensing liquid in an otherwise dry outside environment of said blood treatment circuit, said first leak detector being located to detect leaks from at least a first portion of said blood treatment circuit;
 a second leak detector that detects leaks by sensing air or bubble infiltration into lines of said blood treatment circuit under negative pressure;
 said second leak detector being configured to detect leaks at least in said lines of said blood treatment circuit that connect said patient to said first portion;

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a positive displacement mechanism that insures that at least part of said lines are under negative pressure at least part of the time during a treatment such that a detectable air or bubble infiltration indicates a presence of a leak in said lines;

an alarm device that monitors said first and second leak detectors during a treatment and generates a response signal responsively to a detection of a leak by said first or second leak detector.

Claim 82 (Previously Presented) A device as in claim 81, wherein said alarm device includes an audio alarm signal generator.

Claim 83 (Previously Presented) A device as in claim 81, wherein said positive displacement mechanism includes a pump with a reversible flow direction.